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NET GENERATION STUDENT TEACHERS: HOW TECH-SAVVY ARE THEY?

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Abstract: The present generation of young people is often touted as tech-savvy. They have been variously termed as the "Y Generation" and the "Net Generation" to reflect their technologically inclined nature and living environment. The thrust of this study is to assess student teachers' attitudes, knowledge of ICT (Information Communication Technology) and their context of ICT usage. These factors are important in assessing the tech worth or ICT proficiency of this generation of student teachers in higher education. Information-seeking is a behaviour that is tempered by culture and education within the paradigms of a complex social context and not an intuitive behaviour as posited by the Net Generation Theorists. The findings of this study point to a generation that is undoubtedly active in engaging with technology but not for the reasons cited by Net Generation Theorists. This study utilised a survey method, and data were collected through a self-reported survey questionnaire. Group interviews were conducted to further validate the data obtained. The respondents for this study are student teachers undertaking a bachelor's degree in education at a tertiary institution in Malaysia.

Keywords: net generation, student teachers, ICT skills, net worth, tech savvy

Abstrak: Generasi muda sekarang sering digelar sebagai generasi mahir teknologi. Mereka juga digelar sebagai "Generasi Y" atau "Generasi Net" untuk mencerminkan sifat persekitaran hidup mereka yang cenderung terhadap teknologi. Objektif utama kajian ini adalah untuk menilai sikap guru pelatih terhadap ICT, pengetahuan mereka mengenai ICT dan konteks penggunaan ICT. Faktor-faktor ini adalah penting dalam menilai taraf pengetahuan dan kecenderungan ICT pelajar perguruan di peringkat universiti. Mencari maklumat adalah perilaku yang dipengaruhi oleh budaya dan pendidikan yang tercakup dalam paradigma sosial yang kompleks dan bukan fitrah semula jadi seperti mana yang ditimbulkan oleh *Net Generation Theorist*. Hasil kajian menunjukkan bahawa generasi ini memang cenderung terhadap teknologi tetapi bukan kerana sebab-sebab yang telah diajukan oleh golongan *Net Generation Theorist*. Kajian ini menggunakan kaedah tinjauan (*survey*). Instrumen yang digunakan adalah soal selidik dan wawancara kumpulan. Responden dalam kajian ini adalah pelajar Sarjana Muda Pendidikan di sebuah institusi pengajian tinggi di Malaysia.

Kata kunci: Generasi net, guru pelatih/pelajar perguruan, kemahiran ICT, nilai taraf kemahiran teknologi, mahir teknologi

INTRODUCTION

Malaysia is no stranger to the Information Communication Technology (ICT) landscape. Although it might not be a major global player, Malaysia has made its mark regionally as an ICT-capable nation. Globally, it has contributed to the development of ICT as a manufacturer of ICT components as well as a voracious consumer of ICT products. Past leaders such as Tun Dr. Mahathir have laid out the structural plan for ICT development with the incorporation of cyber cities, the Multimedia Super Corridor (MSC) and its attendant flagship applications (Nain & Anuar, 1998). With the support of developmental funds from the government and the private sector, ICT has grown to become part of the Malaysian culture. For instance, today no shopping complex in any city or town in the country would be complete without an Information Technology (IT) centre housing computer outlets. They are doing brisk business because computers have become part of the household agenda. Research on the use of ICT in various fields has also increased significantly. Conferences, colloquiums, workshops and exhibitions on ICT can be found throughout the year. Malaysian educational institutions from the humble nurseries to universities are set against this background. The school system, both primary and secondary, across a plethora of national, vernacular, religious, technical and select boarding institutions, is an important platform for ICT diffusion. Exposing children to ICT skills and applications at an early age provides them an early impetus towards realising the potentials of ICT and prepares them to embrace it in various stages of their growth from student life to professional reality. The potential of technology in education has also been verified by a large amount of research on children's use of ICT in an educational setting (Berenfeld, 1996; Mioduser, Nachmias, Lahav, & Oren, 1999). On the other hand Tapscott (1998), a Net Generation Theorist, states that for the first time in history, the younger generation is more knowledgeable, informed and skilful than their parents about an innovation central to society's functioning. He also predicts that the younger generation, members of the "Net-Generation", will in time be able to develop and manipulate digital media to the extent that it will impose a new culture on the rest of society. Indeed, research on children's use of ICT primarily describes and examines the potential of the technology within the educational system.

BACKGROUND

The education system plays a crucial role in supporting and realising the country's ICT master plan and fulfilling the aspirations of Vision 2020. The past ten years has seen a rapid transformation of the system to fulfil the manpower needs of this vision. Spearheading this transformation are the nation's ICT-enabled Smart Schools (Chan, 2002). From a pilot project of 90 schools launched in 1999, the concept has been transferred to more than 2,000 schools thoughout the nation. These schools are replete with computer laboratories and PCs in the classrooms, libraries and teachers' rooms. The Ministry of Education has also undertaken several other measures to ensure that the ICT diffusion initiative is successful. This includes the electronic book project and the MySchoolNet website. The training arm of the Ministry, the Curriculum Development Centre and the Teacher Education Division has, trained thousands of in-service and pre-service teachers to use ICT in the classroom since 1992. Currently, one can find ICT-enabled teachers and ICT equipment even in the most remote parts of the peninsula, where electricity is supplied through portable generators. Equipment and basic knowledge are in ample supply, but usage depends on the teacher's attitude, enthusiasm and finer knowledge of the equipment. The present generation of young people is often touted as tech savvy. They have been variously called the "Y Generation" and the "Net Generation" (Tapscott, 1998) to reflect their technologically inclined nature and living environment.

OBJECTIVES

The thrust of this study is to assess the respondent's attitude, skills and knowledge of ICT. These factors are important in assessing the tech worth or ICT proficiency of this generation of youth. In the early 1980s, the capacity of the personal computer (PC) was limited to certain applications such as word processing and accounting. Driving the innovation forward were brand names such as Apple, IBM and Microsoft (Allan, 2005). Within the next decade, these minnows in a little known industry had evolved into giants that spawned IT solutions for every known industry in the market. The development of the Internet, rapid transmission of data through satellite and fibre optic cables, innovative data storage technology and advanced processing technology helped push the IT advancement to greater heights. At the user level, however, these advancements were posing problems never before imagined. Software companies were mushrooming rapidly, producing software for various peripheral functions. While most of it was useful, some was of dubious nature and often overloaded the home

PC's system, resulting in reduced performance. Meanwhile, hacking and the development and deployment of malicious software (malware) were also on the rise. These hostile and intrusive contaminants infiltrated computers without the owner's informed consent, resulting in crashes and the devastating loss or theft of sensitive information. Nevertheless, on the social and academic front, avant-garde applications of technology and the Internet are pushing the status quo to new heights and scenarios in education and social relationships (Oliver, 2002).

Working within this technical landscape, the beginner ICT user must have a number of functional skills to operate a PC. For instance, periodical virus checks and maintenance are vital tools in keeping the PC in good health. Thus, the questions arise: Do our net generation trainee teachers have the needed skills to run a PC without hiccups? What skills have they mastered? How tech savvy are our net generation students in higher education? Answering these questions and others is the objective of this study. Students also spend much of their time on the Internet exploring the blogosphere and intriguing social networking sites. The World Wide Web is indeed a wide forest of tangled information. No matter how open a society may be, socially and legally binding factors still exist that restrict access to certain sites. For instance, there are sites that are deemed detrimental to nation building. In this context, one needs to practice self-restraint or face the law. In Malaysia and Singapore, various cases have already been brought against bloggers in court. Are the local net generation students aware of current cyber laws pertaining to what can be accessed, downloaded or uploaded? Hence, it is also the objective of this study to assess students' awareness of cyber laws. In addition, the present study is designed to acquire information concerning the types of machines and software that students use. In particular, the questions that guide this study are:

1. What is the ICT skill level of the respondents?
2. In what ways do the respondents capitalise on Internet resources?
3. What are the basic specifications of the PCs that the respondents use?
4. Are the respondents aware of the cyber laws that apply in the country?

SIGNIFICANCE

Net Generation Theorists tend to claim that children born after 1985 are extremely tech savvy and adept at handling technology and the Internet. Surfing the Internet and working on computers is supposed to be second nature to them, as they have never known a world without technology or the Internet. However,

anecdotal evidence seems to point to a generation that is undoubtedly active in engaging with technology but not for the reason cited by Net Generation Theorists. Information-seeking is a behaviour that is tempered by culture and education within the paradigms of a complex social context (Case, 2002) and not an intuitive behaviour as posited by the Net Generation Theorists. It has been long suspected that the net generation is not so tech savvy after all. There have been a number of studies (Banwell & Gannon-Leary, 2000; Barr, Garrett, Balzer, Heine, & Houston, 2006; Combes, 2006, 2007; ETS, 2006; Fallows, 2005; Livingstone, Bober, & Helsper, 2005; Nicholas, Rowlands, & Huntington, 2008) that have brought up contrary evidence to show that this generation is not as adept as has been supposed in employing technology as an electronic information resource. In light of these findings, the present study is significant in providing data that could be used to assess the "net worth" of our students pursuing a bachelor's of education degree. If they do indeed take up teaching as a profession, they will be required to work in a technology-oriented teaching environment. Furthermore, students' use of technology is considered an important indicator of their preparedness to succeed and excel in the future (Corbett & Willms, 2002). Assessing their level of technology proficiency and taking corrective measures where needed would be crucial to ensuring the success of the various ICT-based programmes in schools.

Subjects and Procedures

The respondents in this study are second-year students at a tertiary institution in Malaysia. The respondents are between the ages of 19 and 22 and are undertaking a bachelor's degree in Teaching English as a Second Language (TESL). The campus is situated in an urban setting with an abundance of cyber cafes in the vicinity. The campus and classrooms are also equipped with Wi-Fi services. Classrooms, lecture halls and laboratories are equipped with computers, LCD projectors and speakers. This is a typical sample and setting representing the larger population of Malaysian students in higher education institutions. However, generalisations cannot be made beyond the population of 200 students from which the sample was derived. A total of 130 survey questionnaires (Krejcie & Morgan, 1970) were distributed in their classes by their respective lecturers. There was no compulsion to fill in the questionnaires, and only 102 questionnaires were returned to the researchers.

INSTRUMENTS AND METHODS

The survey method was used in this study because the issue of concern was not a phenomenon that could be directly observed (Babbie, 1973). A self-reported survey questionnaire was used as the instrument to collect data. The questionnaire was developed specifically for the present study by the researchers. However, the measurement sub-scales for accessing ICT skills were derived from the Technology Proficiency Self-Assessment Instrument (TPSA) developed by Dr. Margaret Merlyn Ropp, Assistant Professor of Technology Education, University of New Mexico (1999). The first section gathers demographic data pertaining to age, gender, home-state locality and semester of study. The second section is designed to gather information about patterns of ICT utilisation. The third section contains items examining the respondents' ICT skills. This section contains 12 questions on a four-point scale marked as: 1 (None), 2 (Basic), 3 (Proficient) and 4 (Expert). The respondents were asked to self-evaluate their ICT skill level along this continuum. The measurement sub-scales used to assess ICT skills are as follows:

1. word-processing
2. spreadsheets
3. presentation
4. e-mail
5. graphics
6. different file formats
7. Internet
8. Windows/Office
9. file/folder management
10. basic programming
11. install/uninstall software
12. analysing data using a statistical package

Following data analyses, small group interviews were conducted. This procedure helped to elicit reasons for certain student responses. It also helped to enhance the validity and reliability of the findings. The researchers conducted the interviews in small group sessions of five to ten respondents over a period of one week. The questions posed were open ended, and light refreshments were provided; the atmosphere was relaxed, and respondents were able to talk without apprehension. A total of 100 respondents participated in the interview sessions.

Scale scores were obtained by summing the score for each item. The maximum possible score that a respondent could obtain was: 4 (point 4) × 12 (items) = 48. The minimum possible score that a respondent could obtain was: 1 (point 1) × 12 (items) = 12. The scores from the survey would be used on a scale of 12–48 to mark the respondent as a Beginner, Novice, Proficient or Expert (Table 1).

Table 1. Level of technology proficiency

Category	Scale
Beginner	12 – 20
Novice	21 – 28
Proficient	29 – 38
Expert	39 – 48

Quantitative data gathered via the questionnaires were analysed using SPSS (Statistical Package for the Social Sciences) and MS Excel. All variables were analysed by descriptive statistics (i.e. frequencies, means and standard deviations). To test the reliability, the internal consistency of the skill levels questionnaire was measured using Cronbach's alpha coefficient. The alpha for the whole sample was found to be 0.80, indicating a good level of item reliability (George and Mallery, 2003).

Findings

Demographically, the respondents are all students in a tertiary institution, studying for a degree in education. All the respondents were in an age range between 19 and 22 years. The majority (61%) of the students were female, while 39% of students were male. These data are representative of the majority of the student population in Malaysian universities, who are young adults between the ages of 19 to 25 years. A larger proportion of this population is female.

A popular belief is that the "digital native", apart from being tech savvy, is a technology geek who is always up-to-date with the technology they use (Oblinger & Oblinger, 2005; Skiba, 2003; Tapscott, 1998). Our survey produced some details on the type of hardware and software used by these young people. A large proportion of the respondents own and use laptops (85.3%), while only 9.8% own desktops, and 4.9% own and use both laptops and desktops. The most popular PC brand (see Table 2) is Acer (59.8%), followed by HP Compaq (11.8%) and HP (10.8%). In the last 10 years, laptops have rapidly gained the upper hand as the preferred type of PC for students. The technology has also developed in leaps and

bounds. For instance, the weight of laptops has been substantially reduced, while processing capacity has increased tremendously. The lightweight and compact nature of the laptop enables students to carry it with them on and off campus. It has become a ubiquitous and indispensable tool among university students, regardless of how adept they are at handling it. The top ranking models are ones that are found widely in computer outlets, with a range of models and affordable pricing. At present, a student can purchase one of these more popular models for under RM2000. The interviews conducted with the respondents also revealed that pricing rather than capacity and type of software was the main determining factor in their choice of laptop. Furthermore, they did not need a high capacity PC, as most of them say that they use it only for the purpose of word-processing and surfing the net.

Table 2. PC brands

Brand	Frequency	Percent
HP	11	10.8
Acer	61	59.8
Dell	4	3.9
Fujitsu	1	1.0
Asus	2	2.0
Compaq	12	11.8
Twinhead	1	1.0
NEC	1	1.0
Others	9	8.8
Total	102	100.0

Despite the availability of different operating systems (OSs), including open source systems, Microsoft Windows is the most popular OS used by the respondents (99%). A small percentage (1%) reported that they were Linux OS users. Among the Microsoft OS users, 85% were operating on Windows XP, 11% on Vista and 4.9% on Windows 2000. This information is vital as it determines the speed and type of software that they could load and run on their PCs. Integral to the OS is the type or brand of office system that the respondents are using. Our survey indicates that 63.7% are using Microsoft Office 2003, while 35.3% are using Microsoft Office 2007. A small percentage (1%) reported using other systems.

In exploring the net worth and tech savviness of the respondents, our survey also sought information on the hardware components of the PCs they used. For instance, the type of processor and the amount of random access memory (RAM) installed on a PC could determine the amount, density and speed of processing data. As it is with the rest of the world, the respondents were using PCs that run on either Intel or AMD processors. Specifically, 72.5% were using Intel processors, while 17.6% used AMD processors; and 9.8% were unsure of their processor. Intel has a range of processors built for different performance levels. The older processors such as Celeron and Pentium have a lower processing capacity in comparison to the newer ones such as Core Duo and Core 2 Duo. Among those who reported using Intel processors, 30.4% were using PCs that run on Intel Celeron processors, 8.8% used Pentium processors, 22.5% used Core Duo processors, and 10.8% were using PCs that run on Core 2 Duo processors.

As for the amount of RAM installed on the respondents PCs, 38.2% were running on 512-MB modules, 31.4% were using 1-GB modules, 7.8% reported using 2-GB modules, 1% were using 3-GB modules, and 5.9% were using the maximum 4-GB modules. However, a further 15.7% were not sure of the amount of RAM installed on their PCs. Collectively, the data on OS and RAM usage do not reflect a tech savvy disposition. Firstly, Microsoft OS were used almost exclusively. During the interview session, a majority of the respondents, especially female respondents, said they were not aware of any alternative OS. They were also not prepared to experiment with other OS such as Mac OS, Linux or Ubuntu. The extensive use of Windows XP, developed by the Microsoft corporation is understandable because this software is considered to be a tried and tested system, which had captured close to 70% of the market share worldwide (Computer Hope, 2010; Microsoft, 2010; Kramer, 2010). It was introduced in 2001, and in 2009, Microsoft stopped direct public sales of the product. In 2007, Microsoft unveiled the powerful Windows Vista, and in 2009, Windows 7 was released to the public. In comparison to Windows XP, Vista has enhanced security features and better web surfing features. It also supports many of the web 2.0 products that facilitate interactive web surfing: a boon to integrating technology in education. Windows 7, on the other hand, has improved further on the Vista platform. However, operating systems are still a contentious issue, and many experts in the field do not agree on which is better. In conclusion, we could say that any tech savvy person would prefer to use one of the newer Microsoft OS or an alternative platform. The next issue is the amount of RAM loaded on the respondents' PCs and the microprocessor. With the advent of more sophisticated operating platforms and software, it is imperative to have a higher amount of RAM. Vista, for example, requires a minimum of 1-GB of RAM. PCs running on

512-MB modules and Celeron or Pentium processors are painfully slow and inept at handling complex data. The time that it takes to download and upload data from the Internet would also be affected adversely.

According to Sharov (2009), at the beginning of 2009, a malicious programme code named the Win32.HLLW.Shadow worm ensnared millions of computers worldwide: "The programme exploited Windows vulnerabilities, used brute force to administrator password cracking and travelled between computers on removable data-storage devices" (p. 12). This programme is reflective and typical of the countless virus outbreaks every year. At a global level, this particular virus was contained with patches made available by the relevant software producers. However, it could continue to ravish unprotected PCs, especially those without proper antivirus programmes that are regularly updated. Therefore, the installation and maintenance of antivirus protection and firewalls are fundamental steps in avoiding crashes and loss of data (Willems, 2009). This awareness is an integral component of being net savvy. In our study, 92.2% of the respondents reported using an antivirus programme, while 4.9% reported not running any antivirus programmes, and 2.9% were unsure. The study also noted that some antivirus programmes were more popular than others. Table 3 provides the data on the different brands of antivirus programmes used by the respondents.

Table 3. Brand of antivirus

Brand	Frequency	Percent
Norton	15	14.7
Kaspersky	17	17.6
Bit Defender	15	14.7
McAfee	3	2.9
AVG	30	30.4
Avira	15	14.7
Not sure	5	4.9
Total	100	100.0

As for updating antivirus programmes, 83% of the respondents reported updating their antivirus programmes regularly, while 14% reported that they do not update regularly, and 3% were unsure. Our study also sought data on whether the respondents were using completely licensed software, free downloads or pirated software. Data analyses revealed that 20.6% of the respondents were using fully unlicensed (pirated) software, while 22.5% were using legitimate software. The

majority (56.9%), however, relied on free downloads. It is encouraging to note that a large proportion of the respondents run antivirus programmes and also regularly update these programmes. This awareness is definitely a net savvy characteristic. Nevertheless, it would be better if they were also aware of the benefits of using legitimate programmes rather than pirated software or free downloads. The free download options provided by antivirus software developers and vendors are usually incomplete programmes. Using such software could compromise the safety of the PC, as it usually does not include the latest virus definitions.

A popular but misleading notion about the digital divide is the lack of or inequities in Internet access (Petrina, Bartosh, Guo, & Wilson, 2008). The respondents in this study had multiple access points to the Internet. The campus where they study provides free access to Wi-Fi. In fact, most universities and other educational institutions in Malaysia, including public schools, are wired for the web. The majority (83.7%) of the respondents in this study are connected to the web through subscription broadband service, which they can access in the comfort of their rooms or lodgings, while 9.8% make use of cyber cafes. Among those who make use of the free service available, 2% make use of the general campus Wi-Fi service, and 1% prefers using the Wi-Fi service in the campus library. Among those who use subscription broadband services, the most popular service provider is Streamyx (51%). Other service providers are Celcom, Digi, Maxis, Jaring and Time. Being connected (to the Internet) is certainly a net savvy characteristic. The fact that these respondents are willing to pay for the use of the Internet despite the provision of free Wi-Fi services by the university shows how important it is to them. Talks with the respondents revealed that they do not prefer the free services provided as it is often found to be slow. Institutions are often pressured to provide free Internet services but rarely have allocations to provide effective services through higher bandwidth. Another reason provided by respondents for not making full use of the campus Wi-Fi services is that it is often heavily censored and filtered. Access to streaming media and social networking sites are often blocked. However, this censorship is a measure taken to stop students from wasting time on matters unrelated to their education on campus.

Thus far, the study has established how the respondents surf the Web. However, we also need to know what they surf for and how much time they spend on these activities. Before carrying out the study, the researchers conducted informal interviews and chat sessions with the students. Information gathered through this procedure was used to narrow down their web activities to five major areas:

surfing the web for notes, entertainment (music, songs, movies), hobby-related websites, blog spots and social networks. These factors were incorporated in the survey questionnaire, which yielded the following data (Table 4) on the respondents' web activities:

Table 4. Web browsing – hours per-week

Hours per week	Notes	Entertainment	Hobby	Blogs	Social Networks
0–1 hours	7.8	34.3	42.2	51.0	27.5
2–3 hours	36.3	31.4	22.5	27.5	25.5
4–5 hours	28.4	10.8	18.6	15.7	25.5
6–7 hours	10.8	4.9	7.8	2.0	12.7
More than 7 hours	16.7	18.6	8.8	3.8	8.8
Total	100.0	100.0	100.0	100.0	100.0

Apart from spending most of their web surfing time looking for notes and academic related materials, the respondents also spent long hours surfing social networking sites: 89.4% of the respondents were members of social networks. The most popular social network website at the time of this survey was Friendster (50%). This was followed by Facebook (27.5%), Tagged (6.9%), MySpace (4%) and others (1%). However, it is quite evident from these findings that a reasonable amount of their time on the net is spent on matters pertaining to their studies. Nevertheless, an equal proportion of time is spent on entertainment, blogging, hobby-related surfing and social networking. What is also quite evident is the fact that this is a "net savvy" generation that spends a considerable amount time on the net, on and off campus. Interview data show that the respondents often visit social network websites while working on their assignments or while studying. Switching between assignments and Facebook on their laptops, for instance, is a common occurrence. When asked if this switching disturbs their studies, most respondents agreed that it does, but added that they cannot help it, as these social network sites are rather addictive.

As for surfing news portals, 97% responded that they surf for current news online. This includes the web portals of a number of local English and Malay newspapers such the *New Straits Times* online, *The Star* online, *Berita Harian*, *Utusan Melayu*, *Harian Metro* and *Sinar*. The tech and net savvy generation seems to prefer receiving news online rather than in print. This not surprising, as news online is news at their fingertips and free.

For its own internal security reasons, Malaysia enforces strict cyber laws. For instance, in the past couple of years, a number of bloggers have been charged for seditious content found on their blogs (Charles, 2009; Bernama, 2009). The Communications and Multimedia Act of 1998 could be invoked against anyone for unwise use of network or network services by making comments, demands, suggestions or communication deemed vulgar, false, threatening or disturbing. It carries a maximum fine of RM50,000, a maximum jail term of one year or both. Ignorance of the law is not an excuse or defence when you are found guilty of an offence. Hence, it pays to know local cyber laws, even when only posting on a social network website. In the present study, 25% of the respondents said they were aware of Malaysian cyber laws; however, the larger majority (75%) responded that they were not aware of them.

An important aspect of assessing the net worth of the respondents includes evaluating their ICT skill levels. Their self-evaluation of ICT skill levels on a range of sub-skills was measured and tabulated along the following continuum: expert, proficient, novice and beginner. To make the reporting simple and tangible, the expert and proficient categories will henceforth be combined and reported as high levels, while the beginner and novice categories will be combined and reported as lower levels of competency or proficiency.

The percentage of respondents reporting high levels of skills for working with word processing documents was 96.1%. This shows a high level of proficiency in modifying word documents, an essential skill for any student pursuing higher education. However, for spreadsheets, only 51.9% reported a higher level of skills. Data on ICT presentation skills such as the use of MS PowerPoint or Flash were more encouraging, whereby 91.1% reported higher skill levels. As for creating, modifying or manipulating graphics, 79.4% reported higher skill levels. Data analysing skills were also not encouraging, as only 40.2% reported higher skill levels. However, one domain that was disappointing was programming skills. Only 39.3% reported high skill levels in this domain. As higher education students pursuing a degree in education, these respondents would certainly benefit from basic programming skills. This skill would be useful for them in preparing ICT-infused lessons if they decide to pursue teaching as a profession.

Computers can be used to generate, manipulate or operate data in the form of documents, spreadsheets, graphics, audio and video formats. A tech savvy person would also need to know how these data can be saved and retrieved for future use. This involves formatting, file management and software operation skills. For example, certain audio or video files will not start or play correctly if the

appropriate or corresponding codec's are not installed on a computer. Various file formats for documents, spreadsheets and graphic elements also exist. The lack of these skills would be detrimental to the effective use of the programmes and software loaded on a computer. Data analyses revealed that 66.7% of the respondents in this study had high skill levels in operating different file formats. As for file management protocols, 82.3% reported high skill levels, while 66.6% reported high skill levels in manipulating different software. Hence, the respondents are quite savvy in manipulating file formats and managing data and software. The respondents who reported high skill levels in these areas should be able to install the relevant software that they need to run certain applications. They should also be able to save or retrieve data in different file formats. The ability to run regular maintenance checks on the OS represents another skill set important for keeping a computer in good health or in working condition. Microsoft Windows system, for instance, is a popular target for hackers and virus attacks. To counter the weaknesses in the system and to plug any loopholes, Microsoft provides regular patches and updates. The onus is on the user to ensure that these updates are downloaded and installed. According to the survey results, 68% of the respondents reported that they have a high level of skills in maintaining the OS. Installing updates is a procedure that needs to be done on a regular basis, and the user also needs to know how best to do it. There is also separate maintenance software that can be used to clean and run Windows in an optimum condition.

The study also addressed skills associated with information literacy or "information fluency" (Krug, 2004). These are Internet skills needed for browsing, searching, downloading and uploading information, participating in online discussion groups and e-mailing. Overall, 88.3% of the respondents reported high skill levels in sending and receiving e-mails, while 92% reported high Internet skill levels. Hence, with regards to information literacy, the majority of the respondents are indeed tech savvy.

In concluding the findings, the means for all the skill levels for each respondent were calculated (Table 5) to advance an overall ranking of their skill levels. The analysis (Table 6) revealed that 42.2% of the respondents are in the expert category, while 50% are in the proficient category, and 7.8% are in the novice category. None of the respondents fell in the beginner category. Considering that the majority of the respondents are in the expert or proficient category, they can be accorded the status of being tech savvy. Nevertheless, there are still exist certain grey areas of ICT knowledge and skills that could be improved.

Table 5. Descriptive statistics

	N	Mean	Std. Deviation
Word processing	102	3.44	.606
Spreadsheet	102	2.63	.730
Presentation	102	3.38	.676
E-mail	102	3.39	.720
Graphics	102	3.12	.800
File format	102	2.95	.883
Information literacy	102	3.32	.733
Windows maintenance	102	2.88	.882
File management	102	3.21	.848
Programming	102	2.32	.914
Software	102	2.90	.980
Data analysis	102	2.20	1.025

Table 6. ICT skill level

	Frequency	Percent
Expert	43	42.2
Proficient	51	50.0
Novice	8	7.8
Beginner	0	0
Total	102	100.0

CONCLUSION

The findings of this study provide much needed insight into the level and type of ICT skills possessed by students in a first degree level teacher education programme. Although the students could be deemed tech savvy in general, certain weaknesses exist pertaining to their ICT skills and knowledge that require attention. In terms of ICT operational or technical knowledge, there seems to be much work to be done. Firstly, students seem to rely exclusively on certain operating systems. They need to be enlightened on the availability of other operating systems as well. This knowledge would open their horizons to optional software, especially open source systems and freeware. Students also seem to have poor knowledge of how computers work and what can be done to improve performance. Many are using computers with very low levels of RAM

and outdated microprocessors. Students need to be enlightened on the benefits of using genuine software, updating Windows and antivirus software. Without this knowledge and these skills, they are bound to face the misery of loosing data as well time and money on reformatting and reinstalling software, both as students and as teachers in the future. When this damage occurs in the schools where computers and peripheral equipment are installed on a network, their mistakes could become a source of misery for others as well. This dire situation could reflect badly on the institutions in which they were trained in the first place.

Next is the thorny issue of Wi-Fi services provided by the institutions. Majority of students do not seem to benefit from or even appreciate these services due to the low bandwidth provided, causing painfully slow connections. Doubtless institutions have to deal with funding and other constraints, but Wi-Fi services should not be provided as a token service only. In relation to this matter is another contentious issue: The filtering and blocking of Internet content pages. Currently, most public institutions in the country have blanket rules on blocking social networks and streaming media. It is ironic that this should happen while the students have commercial broadband services at their disposal. Blanket blocking and filtering deprives users of the benefits of Net 2.0 applications such as interactive media that can be used effectively in an educational setting. Under these circumstances, institutions might want to consider alternative methods or, at the least, loosening of the regulations.

This brings us to the third issue: Educating students to be responsible users of the web. This study shows that the majority of the respondents are not aware of Malaysian cyber laws. This ignorance of the law is a dangerous situation considering the amount of time the respondents spend on the Internet and the strict nature of local cyber laws. An innocent but sensitive remark on Facebook, for example, could land a student in court. Perhaps educational institutions should add a component in their computer education agenda to enlighten students on what they can and cannot do on the Internet from a legal standpoint. Finally, we come to the issue of ICT skills. In general, the study ascertained that the majority of the students are either in the expert or proficient category. However, there is still space for improvement in the areas of file management, Windows OS management, data analysis, programming and software management. Improved skills in these areas could enhance their net worth and tech savviness. These skills would subsequently ensure effective and productive use of ICT resources, which would benefit them as students and as future teachers. In conclusion, students have played their part in acquiring these skills. However, to further enhance their capabilities, a shift of emphasis needs to occur from the students to the policy

deficits in teacher education curricula. Technology is already in their hands. It is now the choice of the university administrators to address these critical issues.

The present study has brought to light the characteristics of the Malaysian net generation student teacher in higher education. However, due to the small number of respondents and limited locale, the findings cannot be generalised beyond the scope of the study. Further studies need to be conducted involving a larger number of respondents from various educational institutions to provide a more accurate description of the net worth and tech-savviness of the Malaysian net generation student teacher.

REFERENCES

Allan, R. (2005). *A bibliography of the personal computer*. London: Allan Publishing.

Babbie, E. R. (1973). *Survey research methods*. Belmont, CA: Wadsworth Publishing.

Banwell, L., & Gannon-Leary, P. (2000). JUBILEE: Monitoring user information behavior in the electronic age. *OCLC Systems and Services, 16*(4), 189–193.

Barr, D., Garrett, P., Balzer, D., Heine, C., & Houston, B. (2006). *Search challenges as assessment tools: A collaboration between the library and the 21st Century Information Fluency Project in Illinois*. Paper presented at Proceedings of the ALIA Click06 Biennial Conference, Perth, Australia. Retrieved 15 May 2008, from http://conferences.alia.org.au/alia2006/Papers/David_Barr_and_Paula_Garrett.pdf

Bernama. (2009). Bank employee charged with posting obscene blog title. Retrieved 8 January 2010, from http://www.bernama.com/bernama/v5/newsindex.php?id=423326#

Berenfeld, B. (1996). Linking students to the infosphere. *T.H.E. Journal*, *4*, 76–83.

Case, D. O. (2002). *Looking for information: A survey of research on information seeking, needs and behavior.* California: Academic Press.

Chan, Foong-Mae. (2002, October). *ICT in Malaysian schools: Policy and strategies.* Paper presented at Seminar/Workshop on the Promotion of ICT Education to Narrow the Digital Divide, Tokyo, Japan.

Charles, L. (2009). Six to be charged for insulting Perak Sultan via blogs, postings. *The Star*, 12 March 2009. Retrieved 8 January 2010, from http://thestar.com.my/news/story.asp?sec=nation&file=/2009/3/12/nation/20090312194041#

Combes, B. (2006). Techno savvy and all-knowing or techno-oriented? Information seeking behaviour and the Net Generation. *IASL Reports 2006: The Mutiple Faces of Literacy, Reading, Knowing, Doing*, Lisbon, Portugal: International Association of School Librarianship (IASL).

Combes, B. (2007, July). The search for information and the Net Generation. *Cyberspace, D-world, E-learning: Giving libraries and schools the cutting edge.* Paper presented at the 2007 IASL Conference, National Taiwan Normal University, Taipei, Taiwan.

Computer Hope. (2010). Retrieved 9 February 2010, from http://www.computerhope.com/history/windows.htm

Corbett, B., & Willms, J. D. (2002, April/May). *A Canadian students' access to and use of information and communication technology*. 2002 Pan-Canadian Education Research Agenda Symposium, "Information Technology and Learning". Crowne Plaza Montreal Centre Hotel, Montreal, Quebec. Retrieved 23 March 2009, from http://www.cesc-csce.ca/PCeradocs/2002/papers/BCorbett_OEN.pdf

Educational Testing Service (ETS). (2006). *2006 ICT literacy assessment: Preliminary findings*. Retrieved 15 May 2008, from www.ets.org/ictliteracy

Fallows, D. (2005). Search engine users, *PEW Internet & American Life Project*. Retrieved 15 May 2008, from www.pewinternet.org/

George, D., & Mallery, P. (2003). *SPSS for Windows step by step: A simple guide and reference. 11.0 update* (4th ed.). Boston: Allyn & Bacon.

Kramer, D. (2010). *A brief history of Microsoft on the Web.* Retrieved 9 February 2010, from http://www.microsoft.com/misc/features/features_flshbk.htm

Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement*, *30*, 607–610.

Krug, D. (2004). Leadership and research: Reimaging electronic technologies for supporting learning through the visual arts. *Studies in Art Education*, *46*(1), 1–5.

Livingstone, S., Bober, M., & Helsper, E. (2005). *Internet literacy among children and young people: Findings from the UK children go online project*. London School of Economics. Retrieved 3 May 2007, from www.children-go-online.net

Microsoft. (2010). Retrieved 9 February 2010, from http://www.microsoft.com/enable/microsoft/history.aspx

Mioduser, M., Nachmias, R., Lahav, O., & Oren, A. (1999). Web-based learning environments (WBLE): Current implementation and evolving trends. *Journal of Network and Computer Applications, 22*(4)*,* 233–247.

Nain, Z., & Anuar, M. K. (1998, June). *IT strategies in Malaysia: the Multimedia Super Corridor.* Paper presented at the UNRISD conference on Information Technologies and Social Development, Geneva. Retrieved 15 June 2004, from http://www.unrisd.org/infotech/conferen/msc1.htm

Nicholas, D., Rowlands, I., & Huntington, P. (2008). *The information behaviour of the researcher of the future: A CIBER briefing paper*. London: University College London. Retrieved 14 May 2008, from http://www.jisc.ac.uk/whatwedo/programmes/resourcediscovery/googlegen.aspx

Oblinger, D., & Oblinger, J. (2005). Is it age or IT: First steps towards understanding the Net Generation. In D. Oblinger, & J. Oblinger (Eds.), *Educating the net generation*. Retrieved 15 May 2008, from http://www.educause.edu/educatingthenetgen

Oliver, R. (2002). *The role of ICT in higher education for the 21st century: ICT as a change agent for education*. Paper presented at the proceedings of the Higher Education for the 21st Century Conference, Miri, Sarawak.

Petrina, S., Bartosh, O., Guo, R., & Linda Stanley-Wilson. (2008) ICT literacies and policies in teacher education: A survey of preservice teachers at the university of British Columbia. In T. Di Petta (Ed.), *The Emperor's new computer: ICT, teachers and teaching* (pp. 87–107). Rotterdam: Sense Publishers.

Sharov, B. (2009, September). Six month virus activity review from doctor web. *European Expert Group For IT-Security*, 12–15.

Skiba, D. (2003). The Net Generation: Implications for nursing education and practice. In *NLN Living Book*. Retrieved 25 May 2008, from http://electronicvision.com/nln/chapter01/

Tapscott, D. (1998). *Growing up digital: The rise of the net generation*. New York: McGraw-Hill.

Willems, E. (2009, September). The increasing problem of Drive-by downloads. *European Expert Group For IT-Security*, 7–10.